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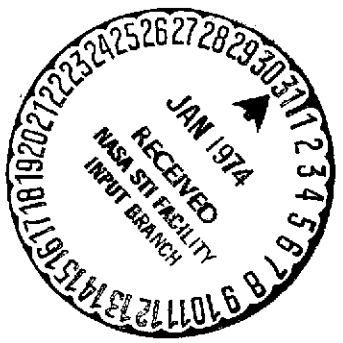
QUESTIONNAIRE SURVEY OF APPROACH LIGHT

N. Iwataki

Translation of "Shin'nyūtō (approach light) ni kansuru shitsumonshi chōsa," Japan Air Self-Defense Force, Aeromedical Laboratory, Reports, Vol. 8, March 1968, pp. 195-198



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16. Abstract

Survey of a questionnaire polling 27 pilots on the efficiency of various method of approach lighting. The Calvert bar system and strobe flash lighting were both considered useful visual aids in approach lighting at low visibility, with strobe flash lighting giving less glare. The pilots agreed, however, that on clear nights approach lighting could cause a disturbing glare in the final landing stage.

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QUESTIONNAIRE SURVEY OF APPROACH LIGHT

Norifusa Iwataki,
Japan Air Self-Defense Force, Aeromedical Laboratory,
Tachikawa, Japan

I. Introduction

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There are several conceivable ways to aid the visual judgment of a pilot during a night flight or in landing under conditions of low visibility. Approach lighting is one of them.

According to the installation standards of the aeronautical enforcement regulations of our country, approach lights are required on a runway used for precision approach and instrumental landing. Other types of runways do not require the installation of approach lights. Only a few airfields controlled by the Japan Air Self-Defense Force have approach lights.

There is no doubt that approach lights are an aid to safe landing; however, there are hardly any data pertaining to just what part of the pilot's judgment they aid.

Therefore, we conducted a questionnaire survey of pilots who have a great deal of experience using approach lights in order to provide basic data on the installation of approach lights.

II. Method

Twenty-seven pilots who fly for commercial air lines were polled in the survey. Their flight experience is shown in Table 1. The pilot with the least experience has 6400 hours flight time, and the average is 10,200 hours.

* Numbers in the margin indicate pagination in the foreign text.

TABLE 1. FLIGHT EXPERIENCE OF SURVEYED PILOTS (27 PERSONS)

		Minimum	Maximum	Average
Total flight hours		6400 h	17,000 h	10,200 h
Jet plane flight hours		1000 h	3000 h	1760 h
Flight hours as captain	Overseas	1000 h	7000 h	2700 h
	Domestic	900 h	6000 h	2900 h

The questionnaire was rather simple, consisting of 13 questions. Six questions concerned approach lighting, while seven concerned strobe flash lighting. The survey was conducted in October 1964.

III. Results and Discussion

1. Usefulness of Approach Lighting

As shown in Table 2, all the pilots surveyed concurred that approach lighting is helpful. Also, all have experienced some inconvenience when approach lighting was not available (Table 3).

TABLE 2. OPINONS ON THE USEFULNESS OF APPROACH LIGHTING

Opinions	Number of answers	Percentage
Better to have approach lighting	27	100
Undecided	0	0
Better not to have approach lighting	0	0

These results clearly prove that the installation of approach /196
lighting is very meaningful for the improvement of flight safety.

TABLE 3. EXPERIENCE OF INCONVENIENCE CAUSED BY LACK OF APPROACH LIGHTING

Experience	Number of answers	Percentage
Often	17	63
Sometimes	9	33
Seldom, not at all	0	0
Do not know	1	4
Total	27	100

2. Effects of Approach Lighting on the Judgment of a Pilot

Approach lighting is advantageous to the pilot as shown in Table 4.

TABLE 4. MERITS OF APPROACH LIGHTING

Merits	Number of answers	Percentage
Easy to locate airport	25	93
Easy to locate approach direction	24	89
Easy to align the plane with the extension of runway	22	82
Easy to determine distance between the plane and the edge of runway	16	59
Guide for flying pattern	10	37
Easy to judge altitude	8	30
Easy to calculate angle of descent	7	26

The operation of landing eventually depends on the pilot's visual judgment of the runway. When the visibility is poor, the visual location of the runway becomes difficult, and making a blind approach, depending solely on instruments, imposes a great strain on a pilot.

When approach lighting is available, a pilot can use it as a guide to locate the runway even when it is not clearly visible. Thus the pilot can control the plane easily, with respect to both time and nerves. This gives the effect of the runway itself being extended, and we can say it is very helpful for flight safety.

3. Improvements Required in Approach Lighting

Sixteen pilots (59%) recognize the necessity of improving current approach lighting, largely with respect to the strength of the lighting. Seven cases show that in the final stages of approach, the glare is sometimes so strong that it is difficult to judge altitude and see the runway. This opinion was not shared by all. A minority of pilots felt that it would be better to be able to adjust or reduce the brightness of the lights and that red light are better, etc.

There were not many who strongly urged the improvement of /197
the arrangement of lighting. Some expressed the idea that the lighting should be arranged in one line of light instead of two or that it should be internationally standardized.

4. Examples of Good Approach Lighting Installation

Among the various examples of approach lighting, the airports shown in Table 5 were recommended as the best of those experienced by the pilot up to the time of the survey. The colors vary from white and red to orange. Most of them employ the same arrangement

of approach lights, i.e., a combination of a line of lights extending from the center of the runway and another line of lights perpendicular to the first. This is similar to the so-called Calvert bar system.

TABLE 5. AIRPORTS WITH EXCELLENT APPROACH LIGHTING

Airport	Number of answers	Airport	Number of answers
Los Angeles	9	London	2
Tokyo	6	Singapore	One each
Hong Kong	5	Honolulu	
San Francisco	4	Anchorage	
Frankfurt	3	Rome	
		Karachi	

A particular case is the Hong Kong airport, where a plane making an approach from the opposite side of the ocean must turn right before the runway to avoid a mountain. The approach lights are arranged in a curve along the line of the turn, and it is said that the operation of the plane is facilitated. This system was later employed at the Osaka International Airport.

5. Usefulness of Strobe Flash Lighting

According to the aeronautical enforcement regulations, installation of strobe flash lighting in the approach lighting is permitted. The intensity is regulated to an integrated value of intensity and time greater than 1000 cd-sec. Also, the strobe flash frequency is set at more than two times per second.

Most pilots consider strobe flash lighting useful (Table 6), especially in conditions of poor visibility, and at night it has

the advantage of being easy to detect from a long distance and cannot be confused with other lights.

TABLE 6. OPINIONS ON THE USEFULNESS OF STROBE FLASH LIGHTING

Opinion	Number of answers	Percentage
Better to have strobe flash lighting	21	78
Undecided	5	18
Better not to have strobe flash lighting	0	0
Do not know	1	4
Total	27	100

6. Glare Caused by Strobe Flash Lighting

There is a fear that strobe flash lighting might glare unduly and disturb the judgment of the pilot despite its high recognition factor. The answers to this question are shown in Table 7, and they show that strobe lighting does not cause much of a problem.

It is only on a clear night that the strobe is relatively glaring to the eyes. In this case, the problem can be solved by turning off only the strobe light.

IV. Conclusion

1. Twenty-seven pilots were polled by questionnaire with regard to approach lighting.

2. Approach lights help pilots' visual judgment in landings /198 in poor visibility.

TABLE 7. OPINIONS ON THE GLARE OF STROBE FLASH LIGHTING

Opinions	Number of answers	Percentage
Glaring	3	11
Depends on the circumstances	6	22
Not glaring	17	63
Do not know	1	4
Total	27	100

3. Most of the airports whose approach lighting is well thought of employ the Calvert bar system.

4. Approach lighting accompanied by strobe lighting makes it easier to locate the runway and its approach direction even in low visibility.

5. In general, the glare of strobe flash lights is not too great.

6. Approach lights sometimes glare at the end of a final approach.

7. The brightness of approach lights should be adjustable and weak enough for certain conditions.

Deep gratitude is due to Mr. Morio Suzuki, Investigator, Crew Training Center of Japan Air Lines Co., Ltd.

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